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EDWARD TELLER

NASA General Interest

NASA

1 January 1969

Dr. Krafft A. Ehricke
1290-A North Coast Hwy.
Laguna Beach, California 92651

Dear Dr. Ehricke:

Thank you for your interesting letter of December 10. I read the enclosure and I strongly agree with your point of view to use what we have and not to wait for further developments.

The chance that I may be able to make a recommendation concerning the personnel in NASA is not great, but I will certainly bear your suggestion in mind.

Sincerely yours,

ET:oc

Edward Teller

DS.

213-836-2011
213-923-8111

Krafft A. Ehricke
1290-A North Coast Hwy.
Laguna Beach, Calif.
92651

10 December, 1968

Dr. Edward Teller
University of California
Lawrence Radiation Laboratory
Berkeley, Calif.
94720

Answer

Dear Dr. Teller:

A good friend, Col. George Colchagoff, with whom you recently discussed possible recommendations for the position as head of NASA, recommended that I send you the enclosed paper which he thinks might be of interest.

We met several times in the past, when you were consultant to General Dynamics Convair. I was also on the USAF committee, headed by you, which investigated the possibilities for early space action by the United States, following the launching of SputnikI. I am presently Chief Scientist of the Advanced Programs Department of North American Rockwell's Space Division. The opinions expressed in the attached paper, however, are my own only. They concern the development of a manned space services program as part of a mixed manned/unmanned spacecraft "task force" for non-military Earth oriented application of our space capability -- a sort of Space Plowshare Program. The enclosure is brief and intentionally avoids details which nobody would read anyway. I would be happy if you found it useful.

One final point. I hope most sincerely that the national space effort will not lose the dedicated and able services of a man of such high caliber as Dr. Edward C. Welsh, Executive Secretary of the National Aeronautics and Space Council. I believe he would be the best choice as the next head of NASA. I know that my opinion is not asked. It is offered anyway, because of Dr. Welsh's actions on behalf of our national space effort which I have observed over the past 10 years. Few men combine so much dedication to our space program with so much leadership capability and statesman-like impartiality. His balanced views recognize the needs of the military, scientific, applicative and operational aspects of our space program. He can be visionary, foresighted, philosophical, pragmatic and practical at the same time. His relations to Congress are of long standing and very good. He realizes the need to view the space program within the broader frame of the many demands on this nation's resources. He is sensitive to the needs of this nation and the civilization for which it stands. I hope you will forgive me for so categorically expressing my opinion as a private citizen who is somewhat knowledgeable of, and deeply concerned about our space program.

Best personal regards,

Krafft Ehricke

Dr Krafft A. Ehricke

MANNED SPACE SERVICE PROGRAM

A Functional and Pragmatic Approach to Integration of Manned Spacecraft Into the Space Application Program Essentially on the Basis of Existing Hardware at the Earliest Possible Time

by

Krafft A. Ehricke

1. The following is not a detailed proposal but suggests a philosophy of approach primarily aimed at the next phase of the manned space program. It is realized that even this phase requires some hardware modifications and developments; but these are reduced to the lowest possible level, compatible with maximum usage of existing manned and unmanned flight hardware. The objective of this suggestion is NOT to argue against the merits of new, more efficient and cost effective manned space flight hardware. These developments must remain our goal for the seventies. The objective is rather to increase the viability of the manned space program first, in order to assure greater readiness of the people, Congress and the Administration, to support the new developments needed. The suggested approach is referred to as the Manned Space Services Program.

2. At this point in time, the manned space program is seriously handicapped in three respects:

   (a) Cuts in the aerospace budget hurt the manned program more than the unmanned program.

   (b) There is widespread "conviction" that the "really useful" portion of the wide spectrum of possible spaceflight missions is comparatively narrow.

   (c) It is also erroneously believed that in the portion rated as useful, man is not needed for some time to come.

3. If funds are restored and a more liberal attitude toward the national space effort (especially the "non-military" part) is resumed, one could suppose that these handicaps would disappear.

4. I am convinced, however, that the situation is not that simple, even in that hypothetical case. Some $20 B̄ have been spent on the realization of manned space flight. It is inconceivable that it should not be possible to apply the acquired capabilities to some missions of immediate and direct usefulness (service to the people of the U.S. and other nations, especially the less developed ones,

as part of our assistance programs). It is inconceivable that this cannot be done essentially on the basis of existing hardware without first requiring still more development funds for new launch vehicles, new upper stages, new logistics vehicles, big space stations, etc.

5. The new developments are needed, of course. But they are not necessary preconditions for doing useful space service missions on the basis of existing capabilities. I believe respect and recognition of the space program by the public and by Congress can be restored more rapidly and profoundly--and that in its wake will come the willingness to support new developments--if they first witness a serious attempt to rise above the eternal development syndrome and emphasize space operations and space service activities.

6. The Apollo Applications Program (AAP) plans by NASA include orbiting flights to test the bio-medical and operational capabilities of a human crew functioning in space over increasingly extended time periods. These tests should accompany rather than be separate from, the space service activities. They should be undertaken in the framework of existing orbiting spacecraft hardware (Command and Service Module (CSM) and attachment modules). In the initial phase, all should be equipped on Earth to avoid the problems of orbital construction and thus increase our ability to provide orbital services at lowest possible cost.

7. The Manned Space Services Program (MSSP) suggested here is designed to provide proof of man's usefulness in space even before the somewhat more elaborate plans for AAP space construction (Orbital Workshop; Orbiting Astronomical Telescope, etc.), which require greater investments and longer preparation times, are undertaken. The MSSP picks up with higher-capability Apollo hardware where the Gemini Program with its first demonstration of manned observational and other useful capabilities in Earth-oriented space activities left off.

8. The existing means available may not be the most cost-effective ones, but the action which can be taken with them will prove to be extremely viability-effective so far as the space program--especially the manned sector--is concerned.

9. For these reasons, I believe a serious attempt should be made to bring manned space program capabilities to bear in the useful portion of the mission spectrum NOW and without first demanding the time and funds to develop new launch vehicles, new logistics vehicles, etc., etc.

10. The attractiveness of a new round of manned space operations is proportional to:

    (a) the relevance of the operation to broader national and world needs,

(b) the need for and usefulness of a human crew in the operation, and

(c) the possibility of minimizing the need for new initial investment as a precondition for a new round of manned space activities.

11. Thus, so far as 10(a) is concerned,

(a) the manned operation would preferably concentrate on starting a flow of practical returns from manned near-Earth-orbit space developments.

(b) The flow of practical returns should begin where it is most visible to people: in the economical sector where it therefore shows the value of manned spaceflight most convincingly.

12. Earth oriented (NOT space-oriented, such as the Orbiting Astronomical Telescope) space services best meet the requirements of 11(a) and (b). These include primarily--and roughly in the order of decreasing importance--the following:

(a) Earth resources surveillance, monitoring and inventorying in the broadest sense of the concept: land, water, organic (agriculture/forestry/oceanic food/fossil raw materials) and inorganic (land/fresh water/inorganic raw materials).

(b) Mesoscale and microscale meteorological research and weather forecasting.

(c) Experiments to improve the space services in 12(a) and (b) above.

(d) Special communication services, such as relaying diplomatic, economic or otherwise privileged information from point to point as orbital "messenger", and other gradually evolving services.

13. All these services call for near-Earth orbit orbits and complement the activity of unmanned satellites in synchronous orbits. Nevertheless, it will be argued that the services can be performed by unmanned spacecraft less expensively. This leads back to 10(b) and therewith to the competitiveness of manned operations vis-a-vis unmanned spacecraft (2(c)).

14. Because of their higher absolute cost, manned orbiting operations must place strong emphasis on economically-redeeming mission features.

15. One economically-redeeming feature is the ability to carry out manned multi-purpose missions.

Present or planned unmanned application satellites are single-purpose spacecraft, "specializing" as communication, weather or Earth resources satellites. While the economic desirability of unmanned multi-purpose spacecraft is frequently emphasized, development of such hardware has been prevented repeatedly, primarily for two practical reasons: Important--i.e. high-priority--missions invariably demand and get specialized spacecraft. An assortment of lower-importance mission purposes never seems able to provide sufficient, bona fide justification for the greater initial investment associated with a multi-purpose spacecraft.

Manned spacecraft offer a solution to this problem. Full confidence in the continued operability--at peak efficiency--of all missions payloads, high or low priority, in a multi-purpose spacecraft is clearly attainable by means of on-the-spot human control, judgment and maintenance; and lower priority customers are served as reliably as those at high priority levels. Thus, the next round of manned space activities should involve all mission purposes listed in 12.

16. Another economically-redeeming feature consists of minimizing the cost of man in the system. This cost factor is a strong argument made consistently in favor of the unmanned approach.

To improve the cost competitiveness of manned space operations relative to unmanned space, the crew size should be kept small (2-4) and the on-board duty period should be as long as possible (3 to 12 months). The cost effectiveness of manning spacecraft improves with the length of the duty cycle.

If Congress can be assured that it would be feasible to send six men on a 750-day fly-by mission to Mars and Venus in 1977, it should certainly be credible that a crew of 2-4 persons can be sent on a 365-day orbiting mission by 1971/72. The level of commitment is not nearly as extreme, since the crew can abort the mission virtually any time and return to Earth on short notice, leaving the spacecraft temporarily in an unmanned operating mode.

17. A third major economically-redeeming feature is that expendables can be resupplied by an unmanned logistic spacecraft on a relatively inexpensive launch vehicle (e.g. Atlas-Burner II or TAT-Burner II), since the crew is on station to receive and install the cargo. A moderate amount of extra-vehicular activity (EVA) is involved, but it is sufficiently small to be considered feasible without first conducting elaborate experiments.

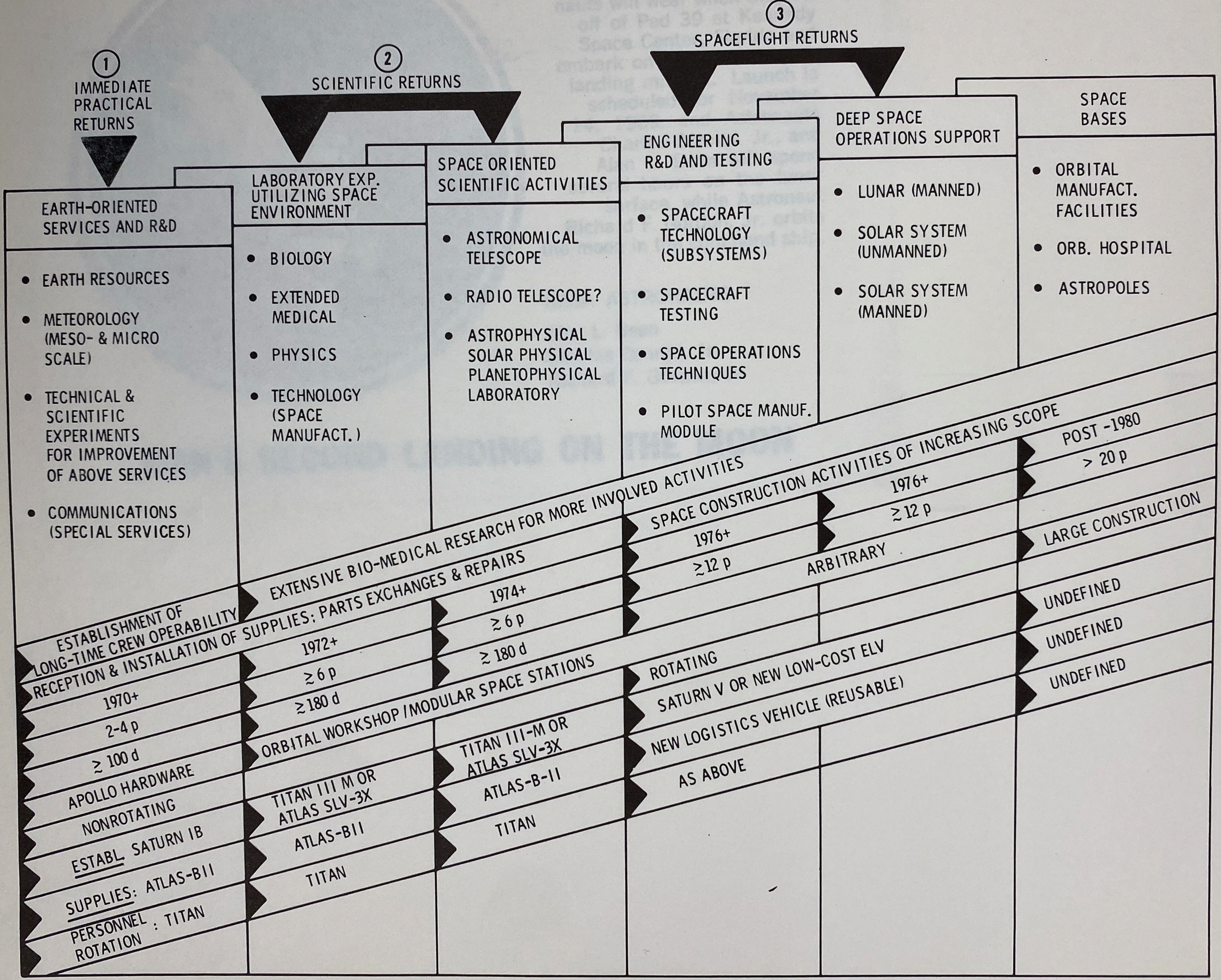
Supplies include not only life support materials, but new scientific equipment for experimentation; spares for subsystem replacement or repairs; and important service materials, such as films and reentry vehicles (RV) for delivery to Earth as part of Earth resources surveillance/monitoring services and meteorological services. In this manner, high-quality, high-resolution pictures can be returned to Earth indefinitely. Unmanned Earth resources spacecraft (ERS) can accommodate only a limited number of RVs. After their deployment, the ERS must be replaced in its entirety. Alternatively, unmanned low altitude Earth resources satellites must rely on a synchronous data relay satellite to transmit high-quality pictures to Earth.

18. A fourth economically-redeeming factor is the accelerated development of Earth-oriented sensors and other payload equipment designed to orient manned space activities toward economical needs of the nation and mankind. This acceleration can be achieved by cooperation between Earth-based scientist and astronaut. Astronauts receive, install, experiment with or try out new equipment sent up to them. They make possible a running exchange of results--a techno-scientific dialogue between Earth and orbit--with progressing experimentation and trials. With man in space to handle and evaluate systems before they are finalized, these expanded possibilities will change the design of experimental equipment to a greater flexibility level, probably reduce equipment cost and reduce the turn-around time from conception to execution of experiments. In the unmanned mode, the entire satellite must be replaced every time new equipment is to be tried out. The establishment of NASA's Application Technology Satellite (ATS) Program constituted recognition of the fact that the development of new equipment is worth even entire unmanned satellites designed especially for this purpose. The advantages of a small manned service installation for accelerating payload development for unmanned as well as manned operations should be recognized.

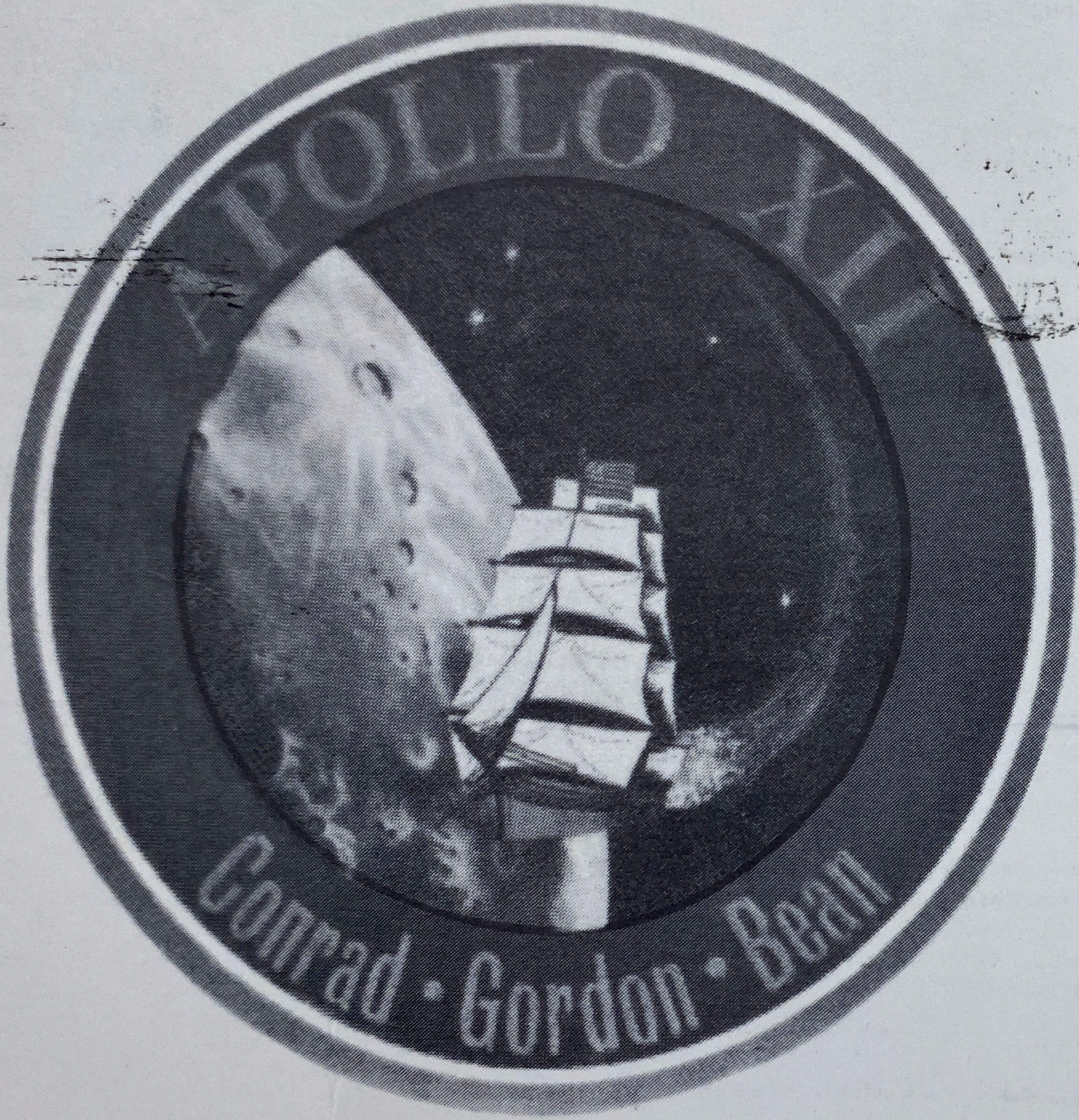
19. Thus, performing sensible and worthwhile services at the present level of our manned spaceflight capability is not only practically feasible, but is more important than providing no services at all until the late seventies. By that time, manned systems will have further progressed; but so will have unmanned systems. In fact, if man is not integrated into the overall operational system of Earth Application Satellites at the beginning of its evolution, it is difficult to reason that integration will be any easier or more logical in the late seventies. Indeed, the opposite may be true. In the past, unmanned systems have displaced the slower evolving manned systems, not the other way around.

20. Therefore, early evolution of a manned-unmanned operational system mix in Earth-space is practical, worthwhile and most likely to support effectively the long-range interests of nation, humanity, scientists and engineers in evermore useful and far-reaching space activities.

21. In summary: Let us do our utmost to keep the manned space program viable by keeping it relevant. We cannot keep it relevant by asking for funds to sustain only another series of new developments (booster/logistics vehicle/space station); nor by directing it toward scientific goals only (astronomy/biology/physics). True relevance can be achieved only by applying present hardware with as few modifications and additions as possible to operational goals in Earth-oriented space applications. The viability assured by successful steps in this direction will be the best guarantee for speedy improvement of our Earth application capabilities through a complementary mix of manned and unmanned Earth services satellites. It will also be a strong indigenous incentive--not based on forever invoking apprehension of Soviet advances as the only viable incentive--for continued investments in the above-mentioned new developments which we know will be needed later in the seventies.


①
IMMEDIATE PRACTICAL RETURNS
②
SCIENTIFIC RETURNS
③
SPACEFLIGHT RETURNS
EARTH-ORIENTED SERVICES AND R&D
• EARTH RESOURCES
• METEOROLOGY (MESO- & MICRO SCALE)
• TECHNICAL & SCIENTIFIC EXPERIMENTS FOR IMPROVEMENT OF ABOVE SERVICES
• COMMUNICATIONS (SPECIAL SERVICES)
LABORATORY EXP. UTILIZING SPACE ENVIRONMENT
• BIOLOGY
• EXTENDED MEDICAL
• PHYSICS
• TECHNOLOGY (SPACE MANUFACT.)
SPACE ORIENTED SCIENTIFIC ACTIVITIES
• ASTRONOMICAL TELESCOPE
• RADIO TELESCOPE?
• ASTROPHYSICAL SOLAR PHYSICAL PLANETOPHYSICAL LABORATORY
ENGINEERING R&D AND TESTING
• SPACECRAFT TECHNOLOGY (SUBSYSTEMS)
• SPACECRAFT TESTING
• SPACE OPERATIONS TECHNIQUES
• PILOT SPACE MANUF. MODULE
DEEP SPACE OPERATIONS SUPPORT
• LUNAR (MANNED)
• SOLAR SYSTEM (UNMANNED)
• SOLAR SYSTEM (MANNED)
SPACE BASES
• ORBITAL MANUFACT. FACILITIES
• ORB. HOSPITAL
• ASTROPOLES
ESTABLISHMENT OF LONG-TIME CREW OPERABILITY
EXTENSIVE BIO-MEDICAL RESEARCH FOR MORE INVOLVED ACTIVITIES
SPACE CONSTRUCTION ACTIVITIES OF INCREASING SCOPE
POST -1980
> 20 p
RECEPTION & INSTALLATION OF SUPPLIES; PARTS EXCHANGES & REPAIRS
1974+
≥ 6 p
≥ 180 d
1976+
≥12 p
1976+
≥ 12 p
ARBITRARY
LARGE CONSTRUCTION
UNDEFINED
UNDEFINED
UNDEFINED
1970+
2-4 p
≥ 100 d
1972+
≥ 6 p
≥180 d
ORBITAL WORKSHOP / MODULAR SPACE STATIONS
ROTATING
SATURN V OR NEW LOW-COST ELV
NEW LOGISTICS VEHICLE (REUSABLE)
AS ABOVE
APOLLO HARDWARE
NONROTATING
ESTABL. SATURN IB
SUPPLIES: ATLAS-BII
PERSONNEL ROTATION : TITAN
TITAN III M OR ATLAS SLV-3X
ATLAS-BII
TITAN
TITAN III-M OR ATLAS SLV-3X
ATLAS-B-II
TITAN

Space Stations - A Functional and Pragmatic Arrangement of Their Evolutionary Phases



WASHINGTON—This is the insignia which Apollo 12 Astronauts will wear when they lift off of Pad 39 at Kennedy Space Center, Florida and embark on the second lunar landing mission. Launch is scheduled for November 14, 1969, and Astronauts Charles Conrad, Jr., and Alan L. Bean will spend several hours on the lunar surface, while Astronaut Richard F. Gordon, Jr. orbits the moon in the command ship.

NASA ASTRONAUTS

Alan L. Bean
Charles Conrad, Jr.
Richard F. Gordon, Jr.

MAN'S SECOND LANDING ON THE MOON

THE NATIONAL SPACE PROGRAM TRULY HAS ANOTHER SIDE . . .

Many startling medical innovations are a direct result space research and technology.

The outgrowth of space microminiaturization is a tiny television camera, so small it can be lowered into a patient's stomach for a detailed study of his ulcers.

A robot-like lunar walker, designed to aid astronauts and their equipment in traversing the irregular surface of the moon, is being experimentally adapted for use by paralytic children. They can maneuver it over curbs and steps, and thereby "walk" for the first time.

In the past a severely paralyzed person could look forward to a dismal future of virtual immobility. Today, thanks to the "magic glasses" developed by space technology, a paralysis victim can steer a motorized wheelchair with a "sight switch" —triggered by movements of the eyeball!

It is even plausible that within the next fifteen years, a by-product of the space industry may help the blind "see" again with the help of a miniature radar rig and television lens "eyes" linked to the optic nerve.

When money is spent in the search for knowledge, however, this knowledge begets new knowledge and develops techniques for a better standard of living, and so on—and at lower total cost. In other words, money spent in the quest for new information keeps coming back to us again and again, whereas money spent directly for a product gives us something of value only once.

In summary, a society that continually invests part of its annual profits into the future is a progressive society. Progressive societies serve their peoples better, in living standards, medicine, and health, and consideration for and by the other nations of the world. We owe it to our heirs to ensure that we remain a free progressive society.

The Dallas Health & Science Museum confirms its support of the nation's space program and asks you to join the undersigned in supplying your support.

Dear Edward & Mici – missed you here for Apollo 12 – glad to hear both of you are making progress most satisfactorily – Hope to be in San Francisco soon – will call first – our best to you both – Bert & Pete

I don't think you'd like it here! No Mountains to climb! See you soon!

KENNEDY SPACE CENTER
NOV 14
AM
1969
FL

NASA

8¢
U.S. AIR MAIL

TO Dr & Mrs Edward Teller
1573 Hawthorne Court
Berkley, California
94708